

What is claimed is:

1. A method of producing a high concentration polymer solution, comprising steps of:

5 dissolving a polymer into a solvent to prepare a low concentration polymer solution; and

continuously concentrating said low concentration polymer solution to obtain said high concentration polymer solution.

10 2. A method as described in claim 1, further comprising a step of filtrating said low concentration polymer solution or said high concentration polymer solution in order to remove solid-state matters of said polymer.

15 3. A method as described in claim 1, wherein part of said solvent that is separated in concentrating said low concentration polymer solution is reused for dissolving said polymer.

20 4. A method as described in claim 3, wherein the polymer concentration of said high concentration polymer solution is from 1 wt.% to 20 wt.% higher than that of said low concentration polymer solution, and the fluctuation of the concentration of said high concentration polymer solution is preserved in a range of a certain targeted value  $\pm 5$  wt.%.

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5. A method as described in claim 3, wherein when  $C_H$  is determined as a predetermined value of the polymer concentration of said high concentration polymer solution, and  $C_L$  is the polymer concentration of said low concentration polymer solution, then the fluctuation of the polymer concentration of said high concentration polymer solution is

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preserved in a range of  $\pm (C_H - C_L) \times 10$  wt.% from the predetermined value  $C_H$ .

5 6. A method as described in claim 1, further comprising the steps of:

continuously feeding said low concentration polymer solution to a concentrating tank;

evaporating part of said solvent of said low concentration polymer solution as a solvent gas in said concentrating tank;

10 condensing said solvent gas to recover as a condensed solvent; and

continuously drawing out from said concentrating tank said high concentration polymer solution obtained during concentrating in said concentrating tank.

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7. A method as described in claim 6, further comprising steps of:

measuring the polymer concentration of said high concentration polymer solution drawn out from said  
20 concentrating tank; and

controlling at least one of volume of said low concentrating polymer solution for feeding into said concentrating tank, temperature of said low concentrating polymer solution for concentrating, and recovering volume of said condensed solvent,  
25 so as to adjust the polymer concentration of said high concentration polymer solution.

8. A method as described in claim 6, further comprising steps of:

30 measuring a level of said low concentration polymer solution in said concentrating tank;

controlling at least one of volume of said low concentration polymer solution for feeding said concentrating tank, temperature of said low concentrating polymer solution for concentrating, and recovery volume of said condensed solvent,  
5 so as to keep the level constant.

9. A method as described in claim 6, further comprising steps of:

measuring recovery volume of said condensed solvent; and  
10 controlling at least one of temperature of said low concentrating polymer solution for concentrating, volume of said low concentrating polymer solution for feeding into said concentrating tank, and temperature for condensing said solvent gas, so as to keep said recovery volume of said condensed solvent  
15 constant.

10. A method as described in claim 6, wherein said concentrating tank including:

a tank main body for temporary storing said low concentration polymer solution while said low concentrated polymer solution is concentrated;  
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a roof disposed on said tank main body, an inner surface of said roof forming a condensation surface for condensing said solvent gas and recovering said condensed solvent;

25 at least one flash nozzle inserted into said tank main body, said flash nozzle being positioned under a solution surface of said low concentration polymer solution in said tank main body while said low concentration polymer solution is concentrated, said flash nozzle discharging said fresh low concentration  
30 polymer solution which is supplied into said tank main body;  
and

a drain pipe which opens on a bottom of said tank main body,  
for draining said high concentration polymer solution.

11. A method as described in claim 10, wherein an end of said  
5 flash nozzle is bent to said bottom of said tank main body to  
form L-shape, and said roof has a circular cone shape.

12. A method as described in claim 10, wherein  
a condensation temperature of said condensation surface is  
10 preserved in a range of a predetermined condensation  
temperature value  $\pm 10^{\circ}\text{C}$ ;

a flash temperature is preserved in a range of  $\pm 10^{\circ}\text{C}$  from  
a predetermined temperature, said flash temperature is a  
temperature of said fresh low concentration polymer solution  
15 to be discharged from said flash nozzle;

a flash pressure is preserved in a range of a predetermined  
flash pressure value  $\pm 0.05\text{ MPa}$ , said flash pressure is a  
pressure of said fresh low concentration polymer solution to  
be discharged from said flash nozzle; and

20 a drainage value of draining said high concentration polymer  
solution through said drain pipe is preserved in a range of a  
predetermined drainage value  $\pm 10\%$ .

13. A method as described in claim 12, wherein said flash  
25 temperature is at least boiling point of said solvent at the  
atmospheric pressure, and said flash pressure is  $0.1\text{ MPa}$  higher  
than a vapor pressure of said solvent at said flash temperature.

14. A method as described in claim 13, wherein an inside  
30 diameter of said flash nozzle is at most  $10\text{ cm}$ .

15. A method as described in claim 13, wherein said inner pressure of said concentrating tank is maximum of 1.5 MPa.

16. A method as described in claim 15, wherein a temperature  
5 of said condensation surface is at least 2 °C lower than a boiling point of said solvent at atmospheric pressure, and a temperature distribution of said condensation surface is maximum of 20 °C.

10 17. A method as described in claim 16, wherein overall heat transfer coefficient of said condensation surface is minimum of 50 W/(m<sup>2</sup>·K).

18. A method as described in claim 17, wherein a heating means  
15 including a heating surface for heating said low concentration polymer solution is provided upstream from said concentrating tank, and the overall heat transfer coefficient of said heating surface is minimum of 50 W/(m<sup>2</sup>·K).

20 19. A method as described in claim 18, wherein a passage of said low concentration polymer solution between said heating means and said concentrating tank is formed of at least one of nickel alloy, stainless alloy, and titanium alloy.

25 20. A method as described in claim 10, wherein when S1 is determined as a area of said solution surface of said low concentration polymer solution in said concentrating tank, and S2 is a area S2 of said condensation surface, then a ratio (S1/S2) satisfies a relation of:

30  $0.01 \leq (S1/S2) \leq 5.$

21. A method as described in claim 10, wherein a pressure in an entrance side of a drain pipe for drawing said high concentration polymer solution is minimum of 1000 Pa.

5        22. A method as described in claim 10, wherein said condensed solvent is drained from said concentrating tank in effect of gravity or surface tension or with a liquid transporting means.

23. A method as described in claim 10, wherein a produce step  
10 of said low concentration polymer solution comprises sub-steps of:

      stirring said low concentration polymer solution;

      increasing a pressure of said low concentration polymer solution; and

15        heating said low concentration polymer solution.

24. A method as described in claim 23, wherein the produce step of said low concentration polymer solution is performed plural times, and when temperature and pressure reach  
20 respective predetermined values, then said low concentration polymer solution is fed toward said concentrating tank.

25. A method as described in claim 10, wherein said solvent contains at least one of dichloromethane, methyl acetate,  
25 methyl formate, acetone, cyclopentanone, cyclohexanone and dioxolane.

26. A method as described in claim 10, wherein parts in a production line for contacting said condensed solvent or said  
30 low concentration polymer solution have surface roughness Ra of maximum of 10  $\mu\text{m}$ .

27. A method as described in claim 26, wherein said production line includes plural concentrating tank.

5        28. A method as described in claim 11, wherein said roof is inclined such that a contact angle of said condensed solvent on said condensation surface may be less than 60°.

10       29. A method as described in claim 25, wherein said polymer contains at least one of cellulose acylate, polycarbonate, aramid based polymers, polysulfone and cycloolefin based polymers.

15       30. A method as described in claim 29, wherein said polymer is cellulose acylate.

20       31. A method as described in claim 30, wherein, when acetyl value of 6<sup>th</sup> hydroxide groups is represented as A, and the acetyl value of 2<sup>nd</sup> and 3<sup>rd</sup> hydroxide groups are represented as B, then said cellulose acylate satisfies following two formulae:

$$2.5 \leq A+B \leq 3.0 \quad \cdots(1)$$

$$0.7 \leq A \leq 1.0 \quad \cdots(2)$$

25       32. A method as described in claim 30, wherein said high concentration polymer solution is cast on a substrate to form a polymer film.

30       33. A method as described in claim 32, wherein said high concentration polymer solution is cast in a co-casting method to form at least one layer of said polymer film.

34. A method as described in claim 32, wherein said high concentration polymer solution is cast in a sequentially casting method to form at least one layer of said polymer film.

5        35. A method as described in claim 32, wherein a number of a light point defect having a size of minimum of 20  $\mu\text{m}$  is observed maximum of 200 in an area of 1  $\text{cm}^2$  of said polymer film sandwiched between cross-nicol polarized films.

10       36. A method as described in claim 32, wherein said polymer film is used as a protective film for a polarizing filter.

37. A method as described in claim 32, wherein said polymer film is used for optical function film.

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